Bilayer Edible Sheet

FIELD OF THE INVENTION

[0001] The present invention relates to a bilayer edible sheet and a process for producing the same. More particularly, the present invention relates to an edible sheet in a food or medicinal field, in which functional ingredients can immediately melt upon ingestion to provide a desired flavorsome, delicious feeling or a pharmaceutical activity to a subject, and which does not show physical fragility, hardening and discoloration and shows suppressed hygroscopicity during a prolonged period storage after production as well as a process for producing the same.

BACKGROUND OF THE INVENTION

[0002] Hitherto, all edible sheets utilized in a food or medicinal field have been a monolayer film which contains all ingredients in a single layer. Consequently, when various functions are imparted to the edible sheet, ingredients essential for constitution of the edible sheet and functional ingredients such as acidulants, flavoring agents, medicines and the like have been mixed together to prepare the monolayer edible sheet.

[0003] However, when the ingredients essential for constitution of the edible sheet and the functional ingredients are contained together in a single layer, there arise problems that physical properties of the sheet are modified to cause fragility, hardening, discoloration and hygroscopicity of the sheet.

[0004] For example, in order to impart fruit-like flavor to the edible

sheet, the edible sheet is conventionally prepared by adding flavoring agents such as spices, concentrated juice or powdered juice to a mixture of sheet-constituting ingredients. But, there arise problems that when a certain juice is mixed with the sheet-constituting ingredients, hardening of the edible sheet is caused due to an interaction between the juice and the sheet-constituting ingredients, or when an acidulant is mixed with the sheet-constituting ingredients, fragility and discoloration of the edible sheet are caused due to a lowered pH.

[0005] Also in a pharmaceutical edible sheet, there arise similar problems when active ingredients to be contained chemically modify the sheet-constituting ingredients.

[0006] Accordingly, in order to avoid above problems, there are problems that a kind or an amount of the ingredients to be contained in the edible sheet must be limited, or a storage duration or condition of the edible sheet must be limited within a particular range. In addition, in a drying procedure of the sheet, there are problems that a drying temperature, a humidity or temperature of a drying air, or the like must be limited within a particular range.

SUMMARY OF THE INVENTION

[0007] In view of such situations, the inventor studied intensively and, as the result, found that above problems can be solved by producing a bilayer edible sheet in which the sheet-constituting ingredients and the functional ingredients which affect the sheet-constituting ingredient to deteriorate physical properties of the edible sheet are contained in separated

layers, which resulted in completion of the present invention.

[0008] Specifically, the inventor found that the edible sheet can be produced by applying on a base sheet layer a mixture of functional ingredients, with an organic solvent which does not substantially dissolve the base sheet layer, resulting in solving the problems as described above. In the edible sheet, the functional ingredients are separated from the sheet-constituting ingredients, and the edible sheet can melt immediately upon ingestion to exert its functions.

[0009] That is, in a first aspect, the present invention provides a bilayer edible sheet obtainable by steps of:

(1) mixing at least one ingredient selected from the group consisting of a starch, a modified starch, a protein, a protein hydrolysate and a gum with water, uniformly applying the mixture on a supporting sheet, and drying the mixture with a hot air to produce a base sheet layer on the supporting sheet;

(2) mixing a surface active agent and at least one functional ingredient selected from the group consisting of a flavoring agent and an acidulant with an organic solvent which does not substantially dissolve the base sheet layer at 30℃ to prepare a mixture of functional ingredients;

(3) applying the mixture of functional ingredients prepared in the step (2) on the base sheet layer produced in the step (1), and air-drying the mixture to form a functional ingredient layer on the base sheet layer; and

(4) removing the base sheet layer from the supporting sheet.

[0010] In addition, in another aspect, the present invention provides a process for producing a bilayer edible sheet comprising steps of:

(1) mixing at least one ingredient selected from the group consisting of a

starch, a modified starch, a protein, a protein hydrolysate and a gum with water, uniformly applying the mixture on a supporting sheet, and drying the mixture with a hot air to produce a base sheet layer on the supporting sheet;

(2) mixing a surface active agent and at least one functional ingredient selected from the group consisting of a flavoring agent and an acidulant with an organic solvent which does not substantially dissolve the base sheet layer at 30℃ to prepare a mixture of functional ingredients;

(3) applying the mixture of functional ingredients prepared in the step (2) on the base sheet layer produced in the step (1), and air-drying the mixture to form a functional ingredient layer on the base sheet layer; and

(4) removing the base sheet layer from the supporting sheet.

[0011] According to the present invention, an edible sheet and a process for producing it in a food or medicinal field can be provided, which can immediately melt upon ingestion to provide a desired flavorsome, delicious feeling or a pharmaceutical activity to a subject. In addition, the edible sheet of the present invention does not cause fragility, hardening, discoloration and hygroscopicity over a prolonged period storage after production.

[0012] Ingredients which constitute a base sheet layer of the edible sheet of the present invention include those contained in a conventional food or medicinal edible sheet. For example, these include a starch, a modified starch, a protein, a protein hydrolysate, a gum, and the like. These ingredients may be contained alone or in combination. For example, a combination of a modified protein and a protein is preferable. In addition, two or more kinds of the same ingredients may be used. For

example, two or more kinds of starches may be used.

[0013] Specifically referring to individual ingredients, the starch includes, for example, rice starch, corn starch, tapioca starch, potato starch, green gram starch, and the like. Such starches may be contained alone or in combination in an amount of 0-90% by weight based on a total weight of ingredients contained in a dried base sheet layer.

[0014] The modified starches includes, for example, Amycol No.6-L^R (Nippon Starch Chemical Co., Ltd.), Foodtex^R (Matsutani Chemical Industry Co., Ltd.), and the like. Such modified starches may be contained alone or in combination in an amount of 0-90% by weight based on a total weight of ingredients contained in a dried base sheet layer.

[0015] The protein or the protein hydrolysate includes, for example, gelatin, gelatin hydrolysate, casein, casein hydrolysate, and the like. Such proteins or protein hydrolysates may be contained alone or in combination in an amount of 0-90% by weight based on a total weight of ingredients contained in a dried base sheet layer.

[0016] The gum includes, for example, carrageenan, gum arabic, propylene glycol alginate, sodium alginate, purified konjac extracts (PROPOL^R (Shimizu Chemical Corporation)), and the like. Such gums may be contained alone or in combination in an amount of 0-10% by weight based on a total weight of ingredients contained in a dried base sheet layer. A concentration of a gum in an aqueous mixture of base sheet ingredients is 0-6% by weight, preferably 0.4-5% by weight, and more preferably 0.4-4% by weight.

[0017] A total concentration of a starch, a modified starch, a protein, a

protein hydrolysate and/or a gum in an aqueous mixture of base sheet ingredients is 20-50% by weight, preferably 25-45% by weight, and more preferably 32-39% by weight.

[0018] Moreover, in addition to the above ingredients, a sweetening agent, a surface active agent, a plasticizer, a coloring agent, a sheet-reinforcing agent, or the like may be optionally contained in the base sheet layer of the edible sheet of the present invention.

[0019] The sweetening agent includes, for example, aspartame (Palsweet^{R} (Ajinomoto Co., Ltd.)), acesulfame potassium (Sunett^{R} (Nutrinova Japan Co., Ltd.)), licorice extracts, and the like. Such sweetening agents may be contained alone or in combination in an amount of 0-30% by weight based on a total weight of ingredients contained in a dried base sheet layer. A concentration of a sweetening agent in an aqueous mixture of base sheet ingredients is 0-15% by weight, preferably 0-10% by weight, and more preferably 0-5% by weight.

[0020] The surface active agent includes, for example, glycerin fatty acid ester, sucrose fatty acid ester, propylene glycol fatty acid ester, and the like. Such surface active agents may be contained alone or in combination in an amount of 0-10% by weight based on a total weight of ingredients contained in a dried base sheet layer. A concentration of a surface active agent in an aqueous mixture of base sheet ingredients is 0-6% by weight, preferably 0.4-5% by weight, and more preferably 0.4-4% by weight.

[0021] The plasticizer includes, for example, glycerol, propylene glycol, glycerin fatty acid ester, medium chain triglyceride (Panasate^{R}

(NOF Corporation) or the like), and the like. Such plasticizers may be contained alone or in combination in an amount of 0-10% by weight based on a total weight of ingredients contained in a dried base sheet layer. A concentration of a plasticizer in an aqueous mixture of base sheet ingredients is 0-5% by weight, preferably 0-4% by weight, and more preferably 0-2% by weight.

[0022] The coloring agent includes, for example, FD&C Yellow No. 5 (Food yellow No. 4 in Japan (tartrazine)), FD&C Red No. 3 (Food red No. 3 in Japan (erythrocin)), FD&C Blue No. 1 (Food blue No. 1 in Japan (brilliant blue)), caramel, and the like. Such coloring agents may be contained alone or in combination in an amount of 0-5% by weight based on a total weight of ingredients contained in a dried base sheet layer. A concentration of a coloring agent in an aqueous mixture of base sheet ingredients is 0-3% by weight, preferably 0-2% by weight, and more preferably 0-1% by weight.

[0023] The sheet-reinforcing agent includes, for example, fats and oils, fatty acid esters, wax, and the like. Such sheet-reinforcing agents may be contained alone or in combination in an amount of 0-10% by weight based on a total weight of ingredients contained in a dried base sheet layer. A concentration of a sheet-reinforcing agent in an aqueous mixture of base sheet ingredients is 0-6% by weight, preferably 0.35-5% by weight, and more preferably 0.4-3% by weight.

[0024] A base sheet layer of the edible sheet can be produced by dissolving or dispersing above ingredients, if necessary with heating, into water to prepare a mixture, uniformly applying the mixture on a supporting

sheet such as a synthetic resin sheet and the like using a coater, a bar coater, or the like, and drying with a hot air according to a conventional procedure for producing edible sheets. Alternatively, depending on the ingredients constituting the base sheet layer, the base sheet layer can be produced by merely applying the mixture on a fluorine- or silicon-processed endless belt conveyer, drying with a hot air, peeling off, winding up in a roll form, and the like, without using the supporting sheet. A thickness of a dried base sheet layer of the edible sheet is 10-200μ m, preferably 10-50μ m, and more preferably 20-50μ m.

[0025] When a thickness of the base sheet is below 10μ m, a mechanical strength of the sheet is lowered, thereby, peeling of the sheet from the supporting sheet in a final step becomes difficult. On the other hand, when a thickness exceeds 200μ m, problems such as a partial peeling or crack may arise upon drying due to a different coefficient of thermal expansion between the supporting sheet and the base sheet. Accordingly, such ranges are not preferable.

[0026] Moreover, functional ingredients, which are contained in the edible sheet of the present invention for imparting various functions thereto, include ingredients which are normally used in a food or medicinal field, and which may adversely effect on the edible sheet as described above upon mixing with ingredients to be contained in the base sheet layer. Such functional ingredients include, for example, a flavoring agent, an acidulant, and the like. Specifically, the flavoring agent includes, for example, fruit flavor, cinnamon flavor, coffee flavor, and the like. Such flavoring agents may be contained alone or in combination in an amount of

0-20% by weight based on a total weight of ingredients contained in a dried edible sheet. A concentration of a flavoring agent in a mixture of functional ingredients in an organic solvent is 0-15% by weight, preferably 2-10% by weight, and more preferably 3-7% by weight.

[0027] Moreover, the acidulant includes, for example, citric acid, tartaric acid, malic acid, fumaric acid, salts thereof, and the like. Such acidulants may be contained alone or in combination in an amount of 0-20% by weight based on a total weight of ingredients contained in a dried edible sheet. A concentration of an acidulant in a mixture of functional ingredients in an organic solvent is 0-15% by weight, preferably 0-10% by weight, and more preferably 0-7% by weight. Furthermore, various ingredients other than the ingredients as described above which do not adversely effect on the edible sheet may be contained in the edible sheet of the present invention.

[0028] Moreover, a surface active agent may be contained in the edible sheet of the present invention in order to dissolve or disperse above functional ingredients in an organic solvent as described below. The surface active agent includes, for example, glycerin fatty acid ester, sucrose fatty acid ester, and the like. Such surface active agents may be contained alone or in combination in an amount of 0-3% by weight based on a total weight of ingredients contained in a dried edible sheet. A concentration of a surface active agent in a mixture of functional ingredients in an organic solvent is 0-3% by weight, preferably 0-2% by weight, and more preferably 0-1.5% by weight.

[0029] An organic solvent, which is used for preparing a mixture of

functional ingredients, may be any one which does not substantially dissolve the base sheet layer, preferably at 20-40℃ and more preferably at 30℃, and which has a low boiling point and may be normally used for producing the edible sheet in a food or medicinal field. The organic solvent includes, for example, acetone, ethyl alcohol, methylene chloride, esters such as amyl acetate, and the like, but preferably is selected from the group consisting of acetone, ethyl alcohol and esters. Such organic solvents may be contained alone or in combination so long as they satisfy the requirements as described above. Although an amount of an organic solvent is not particularly limited so long as it can homogeneously dissolve or disperse the functional ingredients to be used, preferably is suitable for applying the mixture of functional ingredients on the base sheet layer and drying it in a relatively short time. An amount of an organic solvent is, for example, half to three times (weight/weight), preferably half to two times (weight/weight), and more preferably one to one and half time (weight/weight) based on a total amount of functional ingredients except for the organic solvent.

[0030] A mixture of functional ingredients can be prepared by dissolving or dispersing the functional ingredients as described above, if necessary with heating, into an organic solvent.

[0031] As used herein, the phrase "organic solvent which does not substantially dissolve ..." refers to an organic solvent which does not dissolve the base sheet layer by a visual detection, even when it is contacted with the base sheet layer at room temperature for a time necessary for volatizing the solvent.

[0032] Moreover, a drying aid may be optionally contained in the mixture of functional ingredients of the edible sheet of the present invention in order to stabilize the mixture of functional ingredients applied on the base sheet layer or to promote drying of the mixture. The drying aid is not particularly limited so long as it does not dissolve in the mixture of functional ingredients and it can suppress flowing of the mixture of functional ingredients applied on the base sheet layer. In addition, the drying aid should have an average diameter so that drying of the mixture of functional ingredients can be promoted due to an increase in a surface area of the mixture of functional ingredients. The drying aid includes, for example, spherical or formless powder such as corn starch, rice starch, fumaric acid, and the like. An average diameter of such a powder is preferably 5-50μ m, and more preferably 5-20μ m. When the average diameter of powder is below 5μ m, it becomes difficult to suppress flowing of the mixture of functional ingredients or promote drying of the mixture. On the other hand, when it exceeds 50μ m, the edible sheet looks granular and, consequently, an appearance of the edible sheet is deteriorated, being not preferable. Such drying aids may be contained alone or in combination in an amount of 0-40% by weight based on a total weight of ingredients contained in the dried edible sheet. A concentration of a drying aid in a mixture of functional ingredients in an organic solvent is 0-40% by weight, preferably 3-30% by weight, and more preferably 5-15% by weight.

[0033] Moreover, an adhesive may be optionally contained in the mixture of the functional ingredients of the edible sheet of the present

invention in order to fix the drying aid on the base sheet layer or to prevent hygroscopicity of the edible sheet. The adhesive may be any one which can be used in an edible sheet in a food or medicinal field so long as it can stably fix the drying aid to the base sheet layer and can prevent hygroscopicity of the edible sheet under a usual storage or use condition. The adhesive includes, for example, shellac, cellulose derivative, glycerin fatty acid ester, and the like. Such adhesives may be contained alone or in combination in an amount of 0-10% by weight based on a total amount of ingredients contained in the dried edible sheet. A concentration of an adhesive in the mixture of functional ingredients in an organic solvent is 0-10% by weight, preferably 2-7% by weight, and more preferably 3-5% by weight. In addition, the adhesive may be directly added to the mixture of functional ingredients, but it may be added to the mixture after it is prepared into a solution by dissolving in another organic solvent in order to enhance solubility thereof in an organic solvent. For example, when an ester is used as an organic solvent, a solution of shellac in ethyl alcohol is prepared in advance, and the solution is added to the ester into which the functional ingredients have been mixed while stirring, to prepare a mixture of functional ingredients.

[0034] Next, the mixture of functional ingredients prepared is applied to the base sheet layer produced in advance. Application of the mixture of functional ingredients can be conducted using any conventional procedures used in a food or medicinal field. For example, application using a coater or a bar coater, application using offset printing, gravure printing or screen printing, spraying with a sprayer, application using an electrostatic

applicator, and application by a casting method may be used. The mixture of functional ingredients may be uniformly applied on the base sheet layer such that the base sheet layer is covered with the functional ingredient layer.

[0035] Alternatively, the mixture of functional ingredients may be streakily applied on the base sheet layer such that the dried functional ingredient layer forms a particular figure such as a strip, a variety of designs, and the like. Accordingly, when the mixture of functional ingredients is streakily applied on the base sheet layer, there are portions on the base sheet layer where the functional ingredient layer is present and where it is not present. A ratio of an area of the base sheet layer where the functional ingredient layer is present relative to a sum of an area of the base sheet layer where the functional ingredient layer is present and an area of the base sheet layer where the functional ingredient layer is not present may be 30-100%, preferably 35-100%, and more preferably 40-100%.

[0036] When a plurality of edible sheets are stored in a stacked manner, the edible sheet sometimes adhere to neighbor sheets, and it becomes difficult to take one sheet from stacked sheets. In this embodiment, even when a plurality of bilayer edible sheets are stored in a stacked manner, one sheet can be easily taken from stacked edible sheets, since air is present between the stacked sheets, an area of the sheet attaching to other sheets is decreased and, thereby, a sliding ability of the sheet is enhanced. Moreover, in this embodiment, the bilayer edible sheet can immediately melt in an oral cavity upon ingestion due to an increased surface area and, thereby, an effect of the functional ingredients is immediately exerted.

Also, in the pharmaceutical edible sheet, a pharmacological activity of the functional ingredients is immediately exerted. Moreover, a variety of figures as the functional ingredient layer can be drawn on the base sheet layer to enhance aesthetics of the edible sheet. Moreover, the mixture can be dried to produce the bilayer edible sheet in a shorter time than in the case where the mixture is uniformly applied due to the increased surface area. In addition, the edible sheet of this embodiment appears thick compared with one prepared by uniformly applying the same amount of the mixture on the base sheet layer.

[0037] Moreover, when the mixture of functional ingredients is streakily applied such that stripes as the functional ingredient layer are formed on the base sheet layer, cracking of the functional ingredient layer along the stripes can be prevented and, thereby, the functional ingredient layer is hardly peeled off from the base sheet layer.

[0038] Furthermore, the bilayer edible sheet which is produced by uniformly applying the mixture of functional ingredients on the base sheet layer may sometimes curl during a storage due to a difference in a coefficient of expansion between the functional ingredient layer and the base sheet layer, but such curling can be highly suppressed when the mixture of functional ingredients is applied on the base sheet layer in a stripe manner.

[0039] Next, the mixture of functional ingredients applied on the base sheet layer is dried. Drying is preferably conducted at a low to ambient temperature in the light of suppression of denaturation or volatilization of the functional ingredients contained in the mixture, but drying may be

generally conducted under various conditions depending on an organic solvent to be used. For example, drying may be conducted at 20-50℃ for acetone, at 35-80℃ for ethyl alcohol, at 20-40℃ for methylene chloride, or at 20-40℃ for the esters. Since the mixture of functional ingredients can be dried at a relatively low temperature and in a very short time, volatilization of a flavoring agent or the like contained as a functional ingredient can be suppressed, thereby, the edible sheet can be produced without deteriorating its flavor.

[0040] The mixture of functional ingredients of the edible sheet may be applied on the base sheet layer such that a thickness of a functional ingredient layer, which is formed after drying the mixture of functional ingredients, becomes 5-100 μm, preferably 10-40 μm, and more preferably 10-20μm.

[0041] Finally, when the base sheet layer is produced using a supporting sheet as described above, the supporting sheet is peeled off from the base sheet layer after drying the mixture of functional ingredients to obtain a bilayer edible sheet of the present invention. Of course, when the base sheet layer is produced without the supporting sheet, it is not required to peel off it.

[0042] As stated above, the bilayer edible sheet of the present invention which is constituted from the base sheet layer and the functional ingredient layer can be produced by drying the mixture of functional ingredients applied on the base sheet layer. Since the ingredients contained in the base sheet layer and those contained in the functional ingredient layer are separated, the edible sheet which solves the problems

as stated above can be produced.

[0043] The edible sheet of the present invention thus produced has a total thickness, a sum of a thickness of the base sheet layer and that of the functional ingredient layer, of 15-300μ m, preferably 40-80μ m, and more preferably 30-60μ m. Thereafter, the edible sheet of the present invention can be cut into a suitable size, packaged or the like to obtain a final product.

EXAMPLES

[0044] Next, the present invention will be illustrated more specifically with referring to working examples, but the present invention is not limited thereto.

[0045] Example 1

Production of Base Sheet Layer

[0046] Table 1

	Trade name	Manufacturer	Weight(g)	Concentration (%)	Concentration in Dried Base Sheet Layer (% by weight)
Ion-exchanged water			36,727	64.74	—
Gelatin	AP	Nippi Co., Ltd.	9,000	15.86	44.99
Modified starch	Amycol No.6-L	Nippon Starch Chemical Co., Ltd.	9,000	15.86	44.99
Aspartame		Ajinomoto Co., Ltd.	540	0.95	2.70
Acesulfame potassium	Sunett	Nutrinova Japan Co., Ltd.	540	0.95	2.70
Sodium alginate	IL-2	Kimica Co., Ltd.	300	0.53	1.50
FD&C Yellow No.5*		Daiwa dyestuff MFG. Co.	23	0.04	0.11
Glycerin fatty acid ester	Poem DO−100	Riken Vitamin Co., Ltd.	300	0.53	1.50
Sucrose fatty acid ester	SE-S1670	Mitsubishikagaku Foods Corporation	300	0.53	1.50
Total			56,730	100.00	100.00

*FD&C Yellow No.5 in USA corresponds to Food yellow No.4 in Japan

[0047] Into a 100 L stainless steel internal mixer equipped with an agitator, ion-exchanged water was placed, and then gelatin in Table 1 was added with stirring. Mixing was continued with heating so that a temperature of the mixture was maintained at 85℃ using a jacket. After approximately 30 min, the mixture became a homogenous semi-translucent yellow liquid. Then, other ingredients in Table 1 were added and dissolved into the mixture with stirring, and the mixture was degassed. The mixture was applied to a polyethylene terephthalate film having a 60μm thickness (SUNTOX Co., Ltd.) using a coater (Shinko Co., Ltd.) which had been set so that a thickness of a dried sheet becomes approximately 50 μm.

[0048] The mixture applied on the film was dried by passing through a hot-air dryer (Shinko Co., Ltd.) regulated at 75℃ over approximately 5 min to obtain a base sheet layer of the edible sheet having a 50μm thickness.

[0049] Example 2

[0050] Table 2

	Ingredient	Weight (g)	%
1	Corn starch	50	27
2	Anhydrous citric acid	50	27
3	Ethyl alcohol	50	27
4	20% Shellac solution in ethyl alcohol	3	2
5	Lemon oil	30	16
6	Glycerin fatty acid ester	3	2
	Total	186	100

[0051] Ingredients 1-6 in Table 2 were mixed, degassed at a lower

temperature of 20℃ or lower *in vacuo* to prepare a muddy mixture of functional ingredients. The mixture was well stirred, applied to the base sheet layer having a 50μ m thickness which had been produced in Example 1 at a mixture thickness of 40μ m using a coater (Shinko Co., Ltd.), and the mixture was dried with a hot air at 40℃. A thickness of the dried functional ingredient layer was 17μ m, and a lemon-flavored edible sheet having a total thickness, a sum of thicknesses of two layers, of 67μ m was produced.

[0052] Example 3

[0053] Table 3

	Ingredient	Weight (g)	%
1	Corn starch	50	28
2	Sodium carboxymethylcellulose	1	1
3	Anhydrous citric acid	40	23
4	Ethyl alcohol	50	28
5	20% Shellac solution in ethyl alcohol	2	1
6	Orange oil	30	17
7	Sucrose fatty acid ester	3	2
	Total	176	100

[0054] Ingredients 1-7 in Table 3 were mixed, degassed at a lower temperature of 20℃ or lower *in vacuo* to prepare a muddy mixture of functional ingredients. The mixture was well stirred, applied at a mixture thickness of 60μ m to a base sheet layer which had been produced according to the same manner as that of Example 1 except that a thickness thereof was set at 55μ m, using a bar coater (Shinko Co., Ltd.), and the mixture was dried with a hot air at 40℃. A thickness of the dried functional ingredient layer was 20μ m, and an orange-flavored edible sheet

having a total thickness, a sum of thicknesses of two layers, of 75μ m was produced.

[0055] Example 4

[0056] Table 4

	Ingredient	Weight (g)	%
1	Green gram starch	50	28
2	Amyl acetate	1	1
3	Anhydrous citric acid	40	23
4	Methylene chloride	50	28
5	20% Shellac solution in ethyl alcohol	2	1
6	Orange oil	30	17
7	Sucrose fatty acid ester	3	2
	Total	176	100

[0057] Ingredients 1-7 in Table 4 were mixed, degassed at a lower temperature of 20℃ or lower *in vacuo* to prepare a muddy mixture of functional ingredients. The mixture was well stirred, applied at a mixture thickness of 25μ m to a base sheet layer which had been produced according to the same manner as that of Example 1 except that a thickness thereof was set at 30μ m, using a gravure printing machine (Shinko Co., Ltd.), and the mixture was dried with a hot air at 30℃. A thickness of the dried functional ingredient layer was 17μ m, and an orange-flavored edible sheet having a total thickness, a sum of thicknesses of two layers, of 47μ m was produced.

[0058] Example 5

[0059] Table 5

	Ingredient	Weight (g)	%
1	Corn starch	50	27
2	Fumaric acid	20	11
3	Anhydrous citric acid	30	16
4	Ethyl alcohol	50	27
5	Sodium carboxymethylcellulose	1	1
6	20% Shellac solution in ethyl alcohol	2	1
7	Lemon oil	30	16
8	Sucrose fatty acid ester	3	2
	Total	186	100

[0060] Ingredients 1-8 in Table 5 were mixed, degassed at a low temperature of 20℃ or lower *in vacuo* to prepare a muddy mixture of functional ingredients. The mixture was well stirred, applied at a mixture thickness of 60μm to a base sheet layer which had been produced according to the same manner as that of Example 1 except that a thickness thereof was set at 70μm, using a silk screen printing machine (Shinko Co., Ltd.), and the mixture was dried with a hot air at 40℃. A thickness of the dried functional ingredient layer was 19μm, and a lemon-flavored edible sheet having a total thickness, a sum of thicknesses of two layers, of 89μm was produced.

[0061] Example 6

[0062] Table 6

	Ingredient	Weight (g)	%
1	Fumaric acid	50	27
2	Rice starch	20	11
3	Anhydrous citric acid	30	16
4	Ethyl alcohol	50	27
5	20% Shellac solution in ethyl alcohol	2	1
6	Strawberry oil	30	16
7	Glycerin fatty acid ester	3	2
	Total	185	100

[0063] Ingredients 1-6 in Table 6 were mixed, degassed at a low temperature of 20℃ or lower *in vacuo* to prepare a muddy mixture of functional ingredients. The mixture was well stirred, applied at a mixture thickness of 30μm to a base sheet layer which had been produced according to the same manner as that of Example 1 except that a thickness thereof was set at 70μm, using a coater (Shinko Co., Ltd.), and the mixture was dried with a hot air at 40℃. A thickness of the dried functional ingredient layer was 11μm, and a strawberry-flavored edible sheet having a total thickness, a sum of thicknesses of two layers, of 81μm was produced.

[0064] Example 7

[0065] Table 7

	Ingredient	Weight (g)	%
1	Rice starch	30	19
2	Anhydrous citric acid	40	26
3	Ethyl alcohol	50	32
4	20% Shellac solution in ethyl alcohol	3	2
5	Peach essence	30	19
6	Glycerin fatty acid ester	3	2
	Total	156	100

[0066] Ingredients 1-6 in Table 7 were mixed, degassed at a low temperature of 20℃ or lower *in vacuo* to prepare a muddy mixture of functional ingredients. The mixture was well stirred, applied at a mixture thickness of 60μm to a base sheet layer which had been produced according to the same manner as that of Example 1 except that a thickness thereof was set at 50μm, using a bar coater (Shinko Co., Ltd.), and the

mixture was dried with a hot air at 40℃. A thickness of the dried functional ingredient layer was 19μ m, and a peach-flavored edible sheet having a total thickness, a sum of thicknesses of two layers, of 69μ m was produced.

[0067] Example 8

[0068] Table 8

	Ingredient	Weight (g)	%
1	Corn starch	30	19
2	Coffee oil	40	26
3	Ethyl alcohol	50	32
4	20% Shellac solution in ethyl alcohol	3	2
5	Coffee extract powder	30	19
6	Glycerin fatty acid ester	3	2
	Total	156	100

[0069] Ingredients 1-6 in Table 8 were mixed, degassed at a low temperature of 20℃ or lower *in vacuo* to prepare a muddy mixture of functional ingredients. The mixture was well stirred, applied at a mixture thickness of 50μ m to a base sheet layer which had been produced according to the same manner as that of Example 1 except that a thickness thereof was set at 50μ m, using a spray (Shinko Co., Ltd.), and the mixture was dried with a hot air at 40℃. A thickness of the dried functional ingredient layer was 17μ m, and a coffee-flavored edible sheet having a total thickness, a sum of thicknesses of two layers, of 67μ m was produced.

[0070] Example 9

[0071] Table 9

	Ingredient	Weight (g)	%
1	Wheat starch	30	21
2	Hot pepper oil	50	34
3	Ethyl alcohol	50	34
4	20% Shellac solution in ethyl alcohol	3	2
5	Menthol	10	7
6	Glycerin fatty acid ester	3	2
	Total	146	100

[0072] Ingredients 1-6 in Table 9 were mixed, degassed at a low temperature of 20℃ or lower *in vacuo* to prepare a muddy mixture of functional ingredients. The mixture was well stirred, applied at a mixture thickness of 30μ m to a base sheet layer which had been produced according to the same manner as that of Example 1 except that a thickness thereof was set at 35μ m, using a coater (Shinko Co., Ltd.), and the mixture was dried with a hot air at 40℃. A thickness of the dried functional ingredient layer was 10μ m, and a hot pepper-flavored edible sheet having a total thickness, a sum of thicknesses of two layers, of 45μ m was produced.

[0073] Example 10

[0074] Table 10

	Ingredient	Weight (g)	%
1	Rice starch	30	21
2	Green tea powder	50	34
3	Ethyl alcohol	60	41
4	20% Shellac solution in ethyl alcohol	3	2
5	Glycerin fatty acid ester	3	2
	Total	146	100

[0075] Ingredients 1-5 in Table 10 were mixed, degassed at a low temperature of 20℃ or low *in vacuo* to prepare a muddy mixture of functional ingredients. The mixture was well stirred, applied at a mixture thickness of 60μm to a base sheet layer which had been produced according to the same manner as that of Example 1 except that a thickness thereof was set at 50μm, using a coater (Shinko Co., Ltd.), and the mixture was dried with a hot air at 40℃. A thickness of the dried functional ingredient layer was 18μm, and a green tea-flavored edible sheet having a total thickness, a sum of thicknesses of two layers, of 68μm was produced.

[0076] Example 11

[0077] Table 11

	Ingredient	Weight (g)	%
1	Rice starch	30	22
2	Tea powder	20	15
3	Ethyl alcohol	50	37
4	20% Shellac solution in ethyl alcohol	3	2
5	Menthol	10	7
6	Glycerin fatty acid ester	3	2
7	Tea flavor	10	7
8	Lemon oil	5	4
9	Anhydrous citric acid	5	4
	Total	136	100

[0078] Ingredients 1-9 in Table 11 were mixed, degassed at a low temperature of 20℃ or lower *in vacuo* to prepare a muddy mixture of functional ingredients. The mixture was well stirred, applied to a base sheet layer which had been produced according to the same manner as that of Example 1 except that a thickness thereof was set at 50μm, using a

coater (Shinko Co., Ltd.), and the mixture was dried with a hot air at 40℃. A thickness of the dried functional ingredient layer was 18μ m, and a tea with lemon-flavored edible sheet having a total thickness, a sum of thicknesses of two layers, of 68μ m was produced.

[0079] Example 12

[0080] Table 12

	Ingredient	Weight (g)	%
1	Rice starch	30	19
2	Japanese apricot and perilla oil	20	13
3	Ethyl alcohol	50	31
4	20% Shellac solution in ethyl alcohol	3	2
5	Menthol	10	6
6	Glycerin fatty acid ester	3	2
7	Japanese apricot fruit extract	10	6
8	Lemon oil	2	1
9	Anhydrous citric acid	30	19
	Total	158	100

[0081] Ingredients 1-9 in Table 12 were mixed, degassed at a low temperature at 20℃ or lower *in vacuo* to prepare a muddy mixture of functional ingredients. The mixture was well stirred, applied at a mixture thickness of 60μ m to a base sheet layer which had been produced according to the same manner as that of Example 1 except that a thickness thereof was set at 40μ m, using a coater (Shinko Co., Ltd.), and the mixture was dried with a hot air at 40℃. A thickness of the dried functional ingredient layer was 17μ m, and a pickled Japanese apricot-flavored edible sheet having a total thickness, a sum of thicknesses of two layers, of 57μ m was produced.

[0082] Example 13

[0083] Table 13

	Ingredient	Weight (g)	%
1	Rice starch	30	19
2	Grape oil	20	13
3	Ethyl alcohol	60	38
4	20% Shellac solution in ethyl alcohol	3	2
5	Sucrose fatty acid ester	3	2
6	Anhydrous citric acid	40	26
	Total	156	100

[0084] Ingredients 1-6 in above Table 13 were mixed, degassed at a low temperature of 20℃ or lower *in vacuo* to prepare a muddy mixture of functional ingredients. The mixture was well stirred, applied at a mixture thickness of 60μm to a base sheet layer which had been produced according to the same manner as that of Example 1 except that a thickness thereof was set at 50μm, using a bar coater (Shinko Co., Ltd.), and the mixture was dried with a hot air at 40℃. A thickness of the dried functional ingredient layer was 17μm, and a grape mint-flavored edible sheet having a total thickness, a sum of thicknesses of two layers, of 67μm was produced.

[0085] Comparative Examples 1-13

[0086] A monolayer edible sheet as Comparative Example 1 was produced by substituting a 20% by weight of anhydrous citric acid (acidulant) for ion-exchange

d water in a procedure for producing the base sheet layer as described in Example 1. Moreover, monolayer edible sheets as Comparative Examples 2-13 were produced by mixing the ingredients of the functional ingredient layer used in Examples 2-13 and the ingredients of the base sheet layer

described in Example 1, respectively, according to the conventional procedures.

[0087] Evaluation of Edible Sheet Stability

The bilayer edible sheets of Examples 2-13 and the monolayer edible sheets of Comparative Examples 2-13 were placed in separate polyethylene bags, respectively. The bags were heat-sealed, and stored under darkness at 36℃ for 6 months. Thereafter, the edible sheets were recovered, and they were evaluated for discoloration by a visible observation, for hardness by a hand feeling, and for fragility by folding the sheet and determining whether it is divided. The results thereof are shown in Tables 14 and 15.

[0088] Table 14

Example No.	Example 2	Example 3	Example 4	Example 5	Example 6	Example 7	Example 8	Example 9	Example 10	Example 11	Example 12	Example 13
Structure	Bilayer	Bilayer	Bilayer	Bilayer	Bilayer	Bilayer	Bilayer	Bilayer	Bilayer	Bilayer	Bilayer	Bilayer
Functional ingredient	Lemon oil	Orange oil	Cinnamon flavor	Lemon oil	Strawberry oil	Peach essence	Coffee oil etc.	Hot pepper oil	Green tea powder	Tea powder etc.	Japanese apricot and perilla oil etc.	Grape oil
Discoloration after storage	****	****	****	****	****	****	****	****	****	****	****	***
Hardness after storage	unchanged	unchanged	unchanged	unchanged	unchanged	unchanged	unchanged	unchanged	unchanged	unchanged	unchanged	unchanged
Fragility after storage	****	****	****	****	****	****	****	****	****	****	****	****

Discoloration * Significant discoloration; ** Medium discoloration; *** Slight discoloration; **** No discoloration

Fragility - Not determined due to softening of the sheet; * Very fragile compared to at immediately after production;

**** Unchanged compared to at immediately after production

[0089] Table 15

Comparative Example No.	Comparative Example 1	Comparative Example 2	Comparative Example 3	Comparative Example 4	Comparative Example 5	Comparative Example 6	Comparative Example 7	Comparative Example 8	Comparative Example 9	Comparative Example 10	Comparative Example 11	Comparative Example 12	Comparative Example 13
Structure	Monolayer	Monolayer	Monolayer	Monolayer	Monolayer	Monolayer	Monolayer	Monolayer	Monolayer	Monolayer	Monolayer	Monolayer	Monolayer
Functional ingredient	Anhydrous citric acid	Lemon oil	Orange oil	Cinnamon Flavor	Lemon oil	Strawberry oil	Peach essence	Coffee oil etc.	Hot pepper oil	Green tea powder	Tea powder etc.	Japanese apricot and perilla oil etc.	Grape oil
Discoloration after storage	*	*	*	**	*	*	*	**	**	***	**	*	*
Hardness after storage	softening	softening	softening	unchanged	softening	softening	softening	softening	unchanged	unchanged	unchanged	softening	softening

* Significant discoloration; ** Medium discoloration; *** Slight discoloration; **** No discoloration

[0090] As shown in Tables 14 and 15, it was confirmed that bilayer edible sheets of Examples 2-13 caused no discoloration, hardening, fragility of the sheet even after 6 months storage. In contrast, it was confirmed that monolayer edible sheets of Comparative Examples 1-13 caused early discoloration, softening, and fragility.

[0091] Evaluation of Stripe Type Bilayer Edible Sheet

The mixture of functional ingredients was prepared from the ingredients 1-6 in Table 8 as described above. Then, the mixture was streakily applied on the base sheet layer which had been produced according to the same manner as that of Example 1 except that a thickness thereof was set at 65μm, using a coater (Shinko Co., Ltd.) such that the mixture forms 10 stripes on the base sheet layer having 2.2cm width, and the mixture was dried by running it in a hot-air dryer (National EH599, Matsushita Electronic Industry, Co., Ltd.) at a speed of 10m/min to produce a bilayer edible sheet (Stripe type bilayer edible sheet). On the other hand, the same amount of the mixture was uniformly applied on the base sheet layer to produce another bilayer edible sheet (Uniform type bilayer edible sheet). Between such two types of bilayer edible sheets, a drying speed, a thickness, and meltability in an oral cavity were measured and evaluated. The results thereof are shown in Table 16. A thickness of the bilayer edible sheet was measured using a thickness gauge (Teclock Co.).

[0092] Table 16

	Uniform type bilayer edible sheet	Stripe type bilayer edible sheet
Drying speed (Time required for drying)	45sec.	28sec.
Thickness	85μ m	100μ m
Meltability (Time required for melt)	40sec.	25sec.

[0093] As shown in Table 16, it was confirmed that the stripe type bilayer edible sheet can be dried faster than the uniform type bilayer edible sheet. Moreover, when the bilayer edible sheet was produced using the same amount of the mixture of functional ingredients, it was confirmed that the stripe type bilayer edible sheet has a thicker appearance than that of the uniform type bilayer edible sheet. Furthermore, it was confirmed that the stripe type bilayer edible sheet can melt in an oral cavity faster than the uniform type bilayer edible sheet. Therefore, it was found that the bilayer edible sheet produced by streakily applying the mixture of functional ingredients has a variety of superior properties to those of the bilayer edible sheet produced by uniformly applying the mixture of functional ingredients.

[0094] The present invention provides an edible sheet, which can be used in a food or medicinal field, exhibiting various stable physical properties even when various functional ingredients are contained therein with base sheet ingredients.